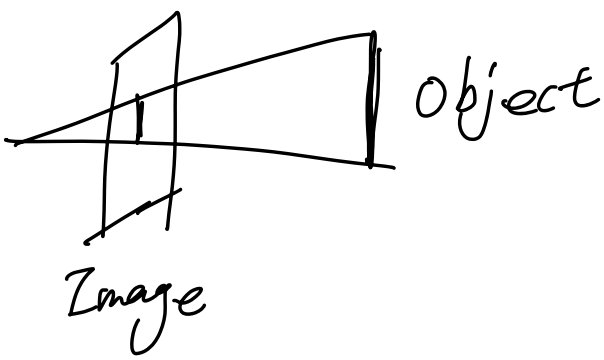
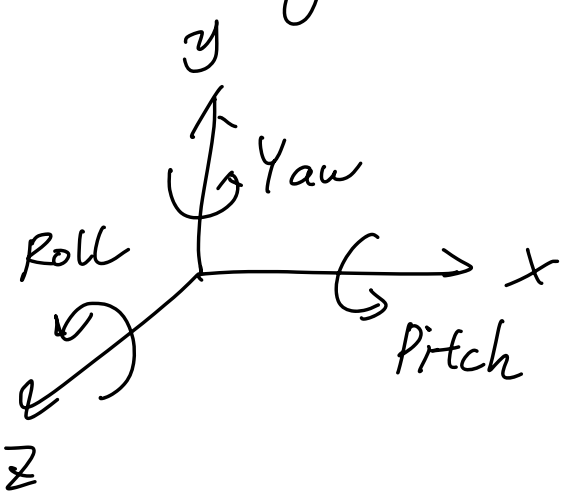
Structure from Motion

Moving camera → structure

Camera Model



Euler Angles



Tracking Method:

- Optical Flow: Pixel displacement (位移) → tracking

- Keypoint (Feature) Tracking

Extract features (point/pattern) → tracking

challenges ① Figure out keypoint to track

② Points may change appearance (angle & shadow)

③ Points may appear/disapear

Approaches — Harris Corner

SIFT — Scale-Invariant Feature Transform

① keypoint: avg max/min DOG$_K$ (高斯差分函数)

(Scale - invariant)

Difference of Gaussian $_K$ = $(G_K - G_1) * I$

ie. Gaussian of difference variance

scave

② descriptor 关键点描述符：减少噪

Histogram {dominant gradient in each small blocks} $\xrightarrow{\text{Rotate}}$ Dominant

计算梯度直方图 Gradient

+ Normalize

Supa point

Image → Cov. → keypoint 2D position

→ Keypoint Description (Descriptor)

Training ① Train on simple shape w. keypoint label

② Homographic Adaptation

Real picture ϕ $\xrightarrow{\text{Rotate}}$ $[P_R]$ $\rightarrow$ Simple Model $\xrightarrow[\text{Averaged}]{\text{Rotate}^{-1}}$ Real Picture w. label

③ Joint Training

Real w label p $\xrightarrow{\text{Rotate}}$ p_R $\rightarrow$ Training S.P. $\rightarrow$ Label loss $(\hat{p}, p)$

$\rightarrow$ Descriptor loss (between P & P_R)